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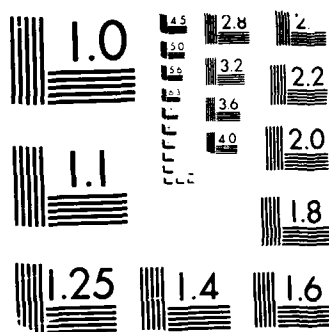
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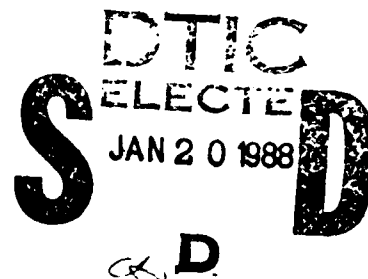
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SYSTEMATICS OF AEDES MOSQUITOES PROJECT

ANNUAL REPORT

Wayne N. Mathis

January 1986



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and technical papers, which summarize data on the ecology, taxonomy, and medical importance of these vectors in Africa. In addition, SAMP performs curation and research on the national collection of mosquitoes at the National Museum of Natural History (NMNH), Smithsonian Institution.

Research continues on the arbovirus vector groups of the subgenera (genus Aedes) Stegomyia (primary focus), Ochlerotatus (secondary), and Diceromyia (secondary) of the Afrotropical Region.



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SUMMARY

The Systematics of Aedes Mosquitoes Project (SAMP), a cooperative venture between the Smithsonian Institution and the U.S. Army Medical Research and Development Command, conducts biosystematic research on mosquitoes of medical importance to the Army. SAMP fulfills these objectives by performing biosystematic studies on important groups of aedine vectors of arboviruses. SAMP provides information on potential vectors for the guidance of military field research teams and other governmental agencies and prepares monographs and technical papers, which summarize data on the ecology, taxonomy, and medical importance of these vectors in Africa. In addition, SAMP performs curation and research on the national collection of mosquitoes at the National Museum of Natural History (NMNH), Smithsonian Institution.

Research continues on the arbovirus vector groups of the subgenera (genus Aedes) Stegomyia (primary focus), Ochlerotatus (secondary), and Diceromyia (secondary) of the Afrotropical Region.

INTRODUCTION

Biosystematic studies, which lead to the precise identification of vectors, are fundamental to any investigation of epidemiology and to the planning of control or eradication. These studies enable recognition of the vector(s); further study of the ecology and habits of the vectors; and effective diffusion of information about vectorial capacity, resistance to insecticides, geographic distribution, etc. Many instances of failure to control diseases resulting from vector-borne pathogens can be traced to neglect of this aspect of research in entomology.

The Systematics of Aedes Mosquitoes Project (SAMP) was developed to perform biosystematic research on medically important mosquitoes to meet the U.S. Army Medical Research and Development Command's requirements for accurate identification of actual or potential mosquito vectors of pathogens of man in Africa. Thus, SAMP is able to respond to these needs and the resources of the project are used to accomplish these requirements. The research was accomplished by 1 professional entomologist plus the principal investigator. The work was supplemented by 4 professional entomologists from the Walter Reed Biosystematics Unit (WRBU) on assignment to the Smithsonian. In addition, upon request, SAMP Assists various military and other medical entomologists in biosystematic studies of medically important mosquitoes. This level of support may range from furnishing entomologists with keys, necessary literature, and other identification guides, to the loan of specialized collecting and rearing equipment, which cannot be obtained from other sources. Such support has proven invaluable to all concerned, as the Smithsonian Institution has received extremely worthwhile material from these entomologists.

REVIEW OF PROGRESS FOR THE PERIOD
August 1, 1984-July 31, 1985 (Yiau-Min Huang)

1. Biosystematic studies of Aedes

A major portion of this period was devoted to hatching mosquito eggs and processing the specimens that were brought back from my field trip to Sierra Leone in early part of 1984. Other tasks included dissecting genitalia, making slide preparations, identifying specimens, resolving taxonomic problems, preparing descriptions and illustrations, and writing manuscripts for publication.

During this period, two manuscripts were submitted for publication. The first paper, entitled "Aedes (Stegomyia) bromeliae (Diptera: Culicidae), the yellow fever virus vector in East Africa," was submitted to the Journal of Medical Entomology. It has been accepted and is scheduled for publication in March, 1986.

The second paper concerns a study on Aedes (Neomelaniconion) lineatopennis (Ludlow). This study specifically responds to requests for identification assistance in support of ongoing USAMRDC research efforts in Africa. The specific purpose is to clarify the taxonomic status of the Aedes "lineatopennis" from that region.

Although specimens determined as Aedes lineatopennis (Ludlow) have been incriminated as vectors of Rift Valley Fever (RVF) in Africa (McIntosh 1972, in Zimbabwe; Davies and Highton 1980, in Kenya; and McIntosh et al. 1980, in South Africa), no one has clearly demonstrated that this species occurs there. Ludlow (1905) originally described this species from specimens collected in Luzon, Philippines, but Edwards (1915) subsequently considered Ae. lineatopennis to be widespread in both the Oriental and Afrotropical regions. Still later, Edwards (1941) and McIntosh (1971) again considered African specimens to be conspecific with the type from the Philippines, and since then, the name lineatopennis has been generally applied to this species in Africa.

A detailed morphological study of all available specimens at SAMP and USNM, has revealed that the so-called "lineatopennis" from Africa is not the same species as specimens from the Philippines, the provenience of the lectotype of Ae. lineatopennis, and that the African populations represent a new species of Aedes in the subgenus Neomelaniconion Newstead.

As a result of this study, a manuscript entitled "A new African species of Aedes (Diptera: Culicidae)" was submitted to the Mosquito Systematics. It was published in July, 1985. This paper reports on the descriptive details and the taxonomic status of a species currently recognized as a primary enzootic vector of RVF in Africa. In addition, diagnostic characters for separating the new species from closely allied species are also given.

The preparation of a manuscript describing a new species of African Stegomyia in the Africanus complex was interrupted due to the urgent requests of a study on Aedes (Neomelaniconion) lineatopennis (Ludlow). This work will resume and will be submitted for publication in Mosquito Systematics during 1986.

In addition to the above, a study was also initiated on the Aedes furcifer-taylori group of the subgenus Diceromyia Theobald. Members of the furcifer-taylori group have been incriminated as vectors of Yellow Fever in Africa (Kirk 1941, and Lewis 1943, in the Nuba mountain, Anglo-Egyptian Sudan; Port and Wilkes 1979, in Gambia). Aedes furcifer has been incriminated as vector of Chikungunya in South Africa (McIntosh et al. 1977; Jupp 1980). Aedes furcifer and Ae. taylori are extremely difficult to separate and have been considered a complex of species for years. Examination of all available specimens at SAMP and USNM thus far has indicated that furcifer-taylori is a complex, consisting of at least 3 species. This study has been hampered by the lack of adequate specimens. To date, five arboviruses (Chikungunya, Dengue, Orungo, Rift Valley Fever, and Yellow Fever) have been isolated from the Ae. furcifer-taylori complex in Africa, of which four cause human illness. With additional material recently obtained from my field trip to the Ivory Coast, this study will continue during this coming year. It is hoped that the study of this material will resolve some of the taxonomic problems related to the furcifer-taylori complex.

Considerable time was devoted to preparing for field work in western Africa, and a very successful field trip was made to the Ivory Coast, from April 23 to June 21, 1985. The purpose of this trip was to undertake field studies in the Ivory Coast, collecting and individually rearing critical material from the locality where it was first discovered, obtaining biological and ecological information, with primary emphasis on potential aedine arboviral vectors, and with secondary emphasis on species of Anopheles and Culex.

In the Ivory Coast, four localities in the Abidjan, Agboville, M'Bahiakro, and Dabakala areas were visited for field collections. Abidjan (Institut Pasteur) and M'Bahiakro (ORSTOM Field Station) were chosen for the field stations for conducting these field studies. A total of 389 collections were made. Special effort was made to collect immatures, particularly the larval stages in the natural habitat and to carry out individual rearings to obtain adults with associated larval and pupal skins. The immature stages are essential for clarifying the identity of a species and resolving species complexes. A total of 182 immature collections were made: ground pool, leaf axil (banana, pineapple, lilly, Sansevieria), stump hole, tree hole, artificial container, fallen leaf on ground, ditch, snail shell, root hole, bamboo stump, log hole. A total of 168 oviposition traps (plastic bottles) were placed in the field for obtaining eggs.

A special effort was also made to collect females of the Africanus complex and the Luteocephalus complex that were attracted to man, at towers (platforms) in M'Bahiakro and Dabakala (ORSTOM's field stations), and to obtain eggs for rearing progeny from individual females. A total of 65 females were collected and placed in oviposition vials for obtaining eggs. Of these, 30 oviposited and the eggs were sent to the Smithsonian. Eggs obtained from individual females as well as from oviposition traps have been hatching at SAMP, Smithsonian, since July, 1985. In addition, a total of 39 adult collections (biting/landing, sweeping) were made from M'Bahiakro and Dabakala areas, of which 215 adult specimens were obtained from Mr. B. Bouchite, ORSTOM. Locality and ecological data were recorded on standard collection forms and are on file with the Smithsonian mosquito collection.

A total of 1865 adults with associated pupal and/or larval skins, and whole larve (1874 vials) belonging to 9 genera (Aedes, Anopheles, Culex, Culiseta, Eretmapodites, Coquillettidia, Mansonia, Toxorhynchites, and Uranotaenia) were obtained from the Ivory Coast. All of the adults have been identified and sorted to genus, subgenus, species complex or species. At least 97% of the total are Aedes, Anopheles, and Culex, and a good series of all stages (male, female, larva, and pupa) were obtained for most species of Aedes, Culex, as well as for the Anopheles gambiae complex. This material will be extremely valuable for current studies at SAMP and WRBU.

2. Curatorial Activities

During this period new material consisting of 674 adults of African Aedes were acquired from the following sources: (1) 33 lots of eggs of Aedes from the Sierra Leone trip were hatched at SAMP. Individual rearings were carried out and adult specimens with their associated larval and pupal skins were prepared at SAMP for taxonomic studies. A total of 645 adults, 558 larval and 645 pupal skins, belonging to five subgenera (Stegomyia, Aedimorphus, Diceromyia, Finlaya, and Pseudarmigeres) of the Genus Aedes, were obtained by this method; (2) 1 lot of eggs of Aedes (Diceromyia) furcifer from Senegal (Dr. M. Cornet, Institut Pasteur de Dakar, Senegal) was hatched At SAMP from which 29 adults, 21 larval, and 29 pupal were obtained. In addition, a total of 160 male and female genitalia were prepared on slides during this period.

3. Other Activities

(1) Assistance was given to Dr. L.G. Mukwaya, Department of Entomology, Uganda Virus Research Institute, Entebbe, Uganda, at SAMP, on identification of mosquitoes, and the methods and techniques of collecting, individual rearing with the preservation of associated larval and pupal skins, preparation of mosquito specimens for taxonomic study and recording field data, from September 11-25, 1984; (2) Identified 125 Aedes (Stegomyia) mosquitoes from Uganda, Liberia, and India, for Dr. L.G. Mukwaya, Uganda Virus Research Institute; LTC B.A. Harrison, WRBU; and Dr. F.P. Amerasinghe, Department of Zoology, University of Peradeniya, Sri Lanka; (3) Reviewed 2 manuscripts written by others for publication.

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Appendix 1: LIST OF SAMP CONSULTANTS

- Dr. Michel Cornet, Institut Pasteur de Dakar (ORSTOM), B.P. 220, Dakar, Republique de Senegal. African Aedes
- Dr. George B. Craig, Jr., Department of Biology, University of Notre Dame, Notre Dame, Indiana 46556. Genetics of Aedes
- Dr. Max Germain, ORSTOM, Head, 70-74 route d'Aulnay, 93140 Bondy, France. African Aedes
- CPT(P) Ralph E. Harbach, Ph.D., Department of Entomology, U.S. Army Medical Component, AFRIMS, APO, San Francisco, CA 96346. Culex of Southwest Asia
- LTC Bruce A. Harrison, Ph.D., Manager, Walter Reed Biosystematics Unit, MSC, Smithsonian Institution, Washington, D.C. 20560. Old World Anopheles and Southeast Asian mosquitoes
- CPT Kenneth J. Linthicum, Ph.D., Department of Arboviral Entomology, U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, Frederick, Maryland 21701-5000. African Aedes and Neotropical Anopheles
- Dr. Botha de Meillon, Philadelphia, Pennsylvania. African Culicidae and Ceratopogonidae
- Dr. J. Mouchet, ORSTOM, Department of Entomology, Bondy, France. Culicidae
- Mr. E L. Peyton, Walter Reed Biosystematics Unit, MSC, Smithsonian Institution, Washington, D.C. 20560. Anopheles
- Dr. Lewis T. Nielsen, Biology Department, University of Utah, Salt Lake City, Utah 84112. North American Aedes (Ochlerotatus)
- COL John F. Reinert, Ph.D., Headquarters USAMRDC, SGRD-DPM, Ft. Detrick, MD 21701. Aedes subgenera
- CPT Daniel A. Strickman, Ph.D., Walter Reed Biosystematics Unit, MSC, Smithsonian Institution, Washington, D.C. 20560. Culex
- Dr. Ronald A. Ward, Department of Entomology, Walter Reed Institute of Research, Washington, D.C. 20012. New World mosquitoes

Appendix 2: MOSQUITOES COLLECTED IN THE IVORY COAST, 1985 (SAMP Acc. 1138)

At least 59 species belonging to 9 genera (Aedes, Anopheles, Culex, Culiseta, Eretmapodites, Coquillettidia, Mansonia, Toxorhynchites, and Uranotaenia) were collected from Ivory Coast. These included 2 new species in Aedes. 29 new species for Ivory Coast [Aedes cummingsii (Theobald), Aedes cummingsii ssp. mediopunctata (Theobald), Aedes domesticus (Theobald), Aedes haworthi Edwards, Aedes minutus (Theobald), Aedes flavicollis Edwards, Aedes furcifer (Edwards), Aedes taylori Edwards, Aedes longipalpis (Guenberg), Aedes fuscinervis (Edwards), Aedes taeniarostris (Theobald), Aedes argenteoventralis (Theobald), Aedes apicoargenteus ssp. denderensis Wolfs, Aedes luteocephalus (Newstead), Aedes unilineatus (Theobald), Anopheles ziemanni Gruenberg, Anopheles hargreavesi Evans, Culex invidiosus Theobald, Culex cinereus Theobald, Culex albiventris Edwards, Culex horridus Edwards, Culiseta fraseri (Edwards), Eretmapodites dracaenae Edwards, Eretmapodites grahami Edwards, Eretmapodites leucopous Graham, Coquillettidia aurites (Theobald), Coquillettidia maculipennis (Theobald), Uranotaenia ornata Theobald and Uranotaenia bilineata var. connali Edwards], 3 subspecies [Aedes cummingsii ssp. mediopunctata (Theobald), Aedes apicoargenteus ssp. denderensis Wolfs and Toxorhynchites brevipalpis ssp. conradti Gruenberg] that should be elevated to full species status.

Aedes (Aedimorphus) nr. abnormalis (Theobald)

- " " cummingsii (Theobald)--(new record for Ivory Coast)
- " " ssp. mediopunctata (Theobald)--(new record for Ivory Coast, should be elevated to specific status)
- " " domesticus (Theobald)--(new record for Ivory Coast)
- " " fowleri (Charmoy)
- " " haworthi Edwards- (new record for Ivory Coast)
- " " minutus (Theobald)--(new record for Ivory Coast)
- " " stokesi Evans
- " " vittatus (Bigot)

Aedes (Diceromyia) flavicollis Edwards--(new record for Ivory Coast)

- " " furcifer (Edwards)- (new record for Ivory Coast)
- " " taylori Edwards- (new record for Ivory Coast)
- " " furcifer/taylori complex- 1 n.sp.

Aedes (Finlaya) ingrami Edwards

- " " longipalpis (Guenberg)- (new record for Ivory Coast)

Aedes (Mucidus) grahami (Theobald)

Aedes (Neomelaniconion) fuscinervis (Edwards)--(new record for Ivory Coast)

- " " palpalis (Newstead)
- " " taeniarostris (Theobald)- (new record for Ivory Coast)

Aedes (Pseudarmigeres) argenteoventralis (Theobald)--(new record for Ivory Coast)

Aedes (Stegomyia) aegypti (Linnaeus)
 " " africanus (Theobald)
 " " apicoargenteus (Theobald)
 " " ssp. denderensis Wolfs- (new record for Ivory Coast, should be elevated to specific status)
 " " bromeliae (Theobald)
 " " dendrophilus complex
 " " nr. opok Corbet and Van Someren--1 n.sp.
 " " luteocephalus (Newstead)- (new record for Ivory Coast)
 " " unilineatus (Theobald)-- (new record for Ivory Coast)

Anopheles (Anopheles) paludis Theobald
 " " ziemanni Gruenberg--(new record for Ivory Coast)

" (Cellia) flavicosta Edwards
 " " funestus Giles
 " " gambiae complex
 " " hargreavesi Evans-- (new record for Ivory Coast)
 " " pharoensis Theobald

Culex (Culex) annulioris Theobald
 " " antennatus (Becker)
 " " decens Theobald
 " " invidiosus Theobald--(new record for Ivory Coast)
 " " nr. weschei Edwards
 " (Culiciomyia) cinereus Theobald--(new record for Ivory Coast)
 " " nebulosus Theobald
 (Eumelanomyia) albiventris Edwards-- (new record for Ivory Coast)
 " " horridus Edwards--(new record for Ivory Coast)

Culiseta (Theomyia) fraseri (Edwards)--(new record for Ivory Coast)

Eretmapodites chrysogaster Graham
 " dracaenae Edwards--(new record for Ivory Coast)
 " grahami Edwards-- (new record for Ivory Coast)
 " leucopous Graham--(new record for Ivory Coast)
 " quinquevittatus Theobald

Coquillettidia (Coquillettidia) aurites (Theobald)--(new record for Ivory Coast)
 " " maculipennis (Theobald)--(new record for Ivory Coast)
 " " metallica (Theobald)

Mansonia (Mansonioides) africana (Theobald)

Toxorhynchites (Toxorhynchites) brevipalpis
 " " ssp. conradti Gruenberg--(should be elevated to specific status)
 " " viridibasis (Edwards)

Uranotaenia (Pseudoficalbia) ornata Theobald-- (new record for Ivory Coast)
 " (Uranotaenia) bilineata var. connali Edwards-- (new record for Ivory Coast)

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